

Utilidad del ecomaraje. Punto de vista del cirujano vascular (Utility of duplex-guided mapping. Vascular Surgeon's point of view)

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Introduction

Duplex machines have greatly improved understanding of varicose vein disease; furthermore the use of a Doppler machine, or, better still, of a duplex scanner (DS) or colour-flow duplex scanner (CFDS), may improve the accuracy of pre-operative marking and of local anaesthesia (LA) administration; similarly surgical procedure can be facilitated and more precise thanks to duplex-derived information¹.

In the diagnostic phase of superficial venous insufficiency, different patterns of morphologic and haemodynamic changes are detectable by DS or CFDS, delineating a made-to-measure surgery for each patient²⁻⁵. Subsequently peri-operative management of the patient may rely upon a detailed (under echo-guidance) skin marking, in order to improve anaesthesia management and surgical procedures (stripping, phlebectomy, CHIVA). In fact we are used to perform saphenous and recurrence surgery in LA, which requires a careful duplex-guided drawing on the skin. Follow-up and post-operative sclerotherapy sessions should be equally based on the duplex findings, even controlled by duplex machines (duplex-guided sclerotherapy).

In our experience this holistic approach for varicose vein surgery, based on the extensive use of duplex imaging, has achieved an improvement in patient-related parameters and valuable functional and cosmetic results.

Patients and methods

After one year of c.w. Doppler device usage, in 1991 we began to use DS and CFDS first of all to draw a map of the VV morpho-haemodynamic condition, and then to mark on the skin the saphenous course, the main perforating veins (PV), the varicose tributaries, the saphenous junction, the neovascularisation sites.

A "tailored" ("a la carte") surgery has been performed in all the cases, abandoning the "blind" groin-to-ankle stripping. In fact, pre-operative CFDS investigation has revealed a complete incompetence of LSV (from the junction downwards to the ankle) only in 3% of the examined limbs⁶, justifying segmental strippings as gene-

ral route since 1990. A radical crossectomy and a tailored stripping of saphenous veins has been the favourite surgical procedure, together with phlebectomy by mini-incisions.

Large incompetent perforating veins (PV) in the thigh have been tied when located in extra-saphenous site. Leg PV have very rarely been tied (0,9% of the cases from 1996), preferring phlebectomy, or the absolute surgical abstention for the re-entry PV in the lower part of the leg. This attitude is justified by previous reports of other authors^{7,8} and by a recent personal CFDS study^{6,9,10}, where it has been evidenced that in cases of primary varicose veins the vast majority of the PV located in the leg tend to restore or to maintain competence after saphenous stripping and phlebectomy; furthermore PV always become smaller in the post-operative CFDS mid-term follow-up.

Recurrences have been treated according to the CFDS findings: phlebectomy and/or saphenous stripping (when the trunk of LSV or SSV was still in situ) in all cases, whereas the re-intervention in the groin or in the popliteal area has been performed when an intact saphenous junction (long stump) was present; duplex guided sclerotherapy (with sclerosing foam use) has been preferred¹¹ for the neovascularisation arising from common femoral vein or popliteal vein through small branches or from extra-femoral (pelvic) refluxes.

Since 1991 we improved our technique of LA, thanks to the growing experience with pre- and intra-operative DS or CFDS use, which led us to significantly reduce both the dosage and the concentration of local anaesthetic solution (actually 0,25% buffered mepivacaine without adrenaline for all the operation sites).

Furthermore the pre-operative DS or CFDS evaluation may be transformed in a preliminary map of the anatomical and haemodynamic condition, paying special attention to the typical useful information for the surgeon (diameters, abnormalities, course, depth of the "target"-structures and so on).

Ultrasound guided marking may comprise: a. saphenous junctions and course; b. large PV; c. points of transfer of reflux from saphenous stem to tributaries (or to a single tributary) and d. re-enters of the reflux from tributary to saphenous stem or to one or more PV, e. large competent saphenous tributaries (possible break sites). The depth references of saphenous junction and trunk may be marked.

In cases of VV arising from anterior saphenous vein (ASV) incompetence (quite frequent in our last years experience, as often misdiagnosed previously...), the LSV course is marked, as well as typology of ASV junction (mainly of "lambda" nature).

Possible LSV or SSV stem duplication (very rare, as in 0,2 % in our experience, and similarly reported by other authors¹²) is carefully marked, to avoid the erroneous stripping of healthy venous segments.

A dotted line characterises the deeper superficial trunk (i.e. LSV, SSV, Giacomini's vein and ASV, which all lie into a compartment between the two superficial fascias or between superficial and muscular fascia¹²⁻¹⁵); on the other hand a non-interrupted line runs over the visible or very superficial veins, which are anyway targeted by duplex guide when they are not visible, or frankly palpable. The largest PV are marked by small circles, especially if located in extra-saphenous territory.

Other findings which concern the pre-operative marking are: anatomic abnormalities, such as incompetent PV contiguous to LSV junction, or infra-arterial LSV junction, SSV confluence with extra-popliteal (gastrocnemial, femoral) veins, the point of SSV course which is the most proximal to popliteal skin fold (where we routinely make the 2-3 cm long incision for the junction treatment)¹⁵.

Results

Relying upon the ultrasonographic guide and the pre-operative DS or CFDS diagnostics, several morphologic and haemodynamic patterns have been pre-operatively elucidated, which led us to reserve venography only to 4 patients from 1996 to 2000.

Diagnostic pre-operative management of the patients by means of DS and CFDS opened a window on a great variety of different anatomical and haemodynamic patterns in varicose vein disease.

In our case record of varices generated by LSV incompetence, CFDS exploration found LSV terminal valve contenance (LSV retrograde flow without any reflux from common femoral vein at the sapheno-femoral junction) in 28% of the limbs: in these conditions the reverse flow has been detected as coming from abdominal-pelvic source, or strictly from the peripheral LSV stem, as already reported by previous studies¹⁶⁻¹⁸. Concerning the segmental distribution of LSV reflux (from the junction towards the stem), we have found the following data obtained by means of CFDS pre-operative mapping of 225 limbs (as previously published⁶): in 33 limbs (15%) the reflux was extended from the junction to the superior-medium third of the thigh, in 68 cases (30%) the reflux left LSV at the lower third of the thigh, in 118 LSV (52%) the reflux moved to a tributary at the upper-medium third of the leg and finally only in 6 cases (3%) the whole LSV had reflux down to the ankle.

All the information obtained by ultrasonic diagnostics has been reflected in a made-to-measure (or "tailored") surgical approach. More notably a conservative approach has been possible, sparing in the vast majority of the patients long tracts of healthy saphenous stems and most PV (in the last 1824 interventions we have tied in the leg 18 PV, 0,9%, due to the preference for phlebectomy or for the absolute abstention^{6,9,10} for the re-entry perforators).

Another aspect of Ultrasound guided marking has been the minimisation of all the scars: an incision of 2 to 3 cm has been possible in the vast majority of the patients for inguinal and popliteal region, while incisions of 1-2 mm were made for phlebectomy, sometimes even smaller thanks to the use of 18G needle. Finally CFDS has allowed to visualize lymph nodes in the proximity of saphenous junctions or stems, aberrant arteries and other anatomic abnormalities, and this resulted in a significantly safer surgical dissection.

Discussion

Varicose vein operations have improved, since about 20 years ago, by the use of ultrasonography, due to a more accurate diagnostics, and a more guided and modulated therapy¹⁹. Varicose vein disease presents several different morphologic and haemodynamic patterns^{3,20} and the time of one single surgical procedure for all the limbs is definitively finished: our experience, in accordance with many other previous studies^{4,21,22}, indicates that a more conservative surgery is mandatory, to avoid excising too much and to adequately control the natural evolution of this disease. This attitude should rely upon duplex technology, which provides a formidable wide range of information.

Duplex investigation is unfortunately an operator-dependant method, but an extensive use of these tools in varicose vein surgery is recommended, to reduce the use of invasive venography further, and to abandon diagnosing by the blind hands and the very limited possibilities of hand-held doppler.

Local anaesthesia may represent a further step towards a mini-invasive surgery and DS or CFDS are able to provide precious information to make LA management easier and more precise. Furthermore in our experience the ductility of these ultrasonographic tools has allowed us to achieve a pre-operative map, to draw a correct marking on the limb and to perform a strict follow-up.

Surely such a demanding approach, due to the necessity to manage different aspects altogether, may induce an overload of work for the operating team, but our¹ and others' experience²⁻⁵ seem to prove the efficacy of this attitude, with an ergonomics and economic enhancement.

References

1. Cavezzi A, Carigi V, Collura M. Colour Flow Duplex Scanning as preoperative guide for mapping and for local anaesthesia in varicose vein surgery *Phlebology* 2000;15:24-9.
2. Uhl JF, Lefebvre-Villardeb M, Lemasle Ph. L'écho-marquage préopératoire des varices des membres inférieurs. *Phlébologie* 1995;48(3):359-65.
3. Goren G, Yellin AE. Primary varicose veins: topographic and haemodynamic correlation. *J Cardiovasc Surg* 1990; 31:671-7.
4. Creton D. Influence des examens ultrasonores préopératoires pour une chirurgie d'exérèse variqueuse plus conservatrice. *Phlébologie* 1994;47(3):227-34
5. Ricci S, Georgiev M, Goldman M. *Ambulatory Phlebectomy*. New York: Mosby Ed, 1995.

6. Cavezzi A. Diagnostic de l'insuffisance veineuse superficielle des membres inferieurs par echo-doppler couleur, *Phlébologie* (in publication, January 2000 issue).
7. Campbell WA, West A, Negus D, *et al.* Duplex ultrasound audit of operative treatment of primary varicose veins. En: Negus, *et al.*, edit. *Phlebology* 95, *Phlebology* 1995;Suppl 1:407-9.
8. Stuart WP, Adam DJ, Allan PL, Ruckley C, Bradbury AW. Saphenous surgery does not correct perforator incompetence in the presence of deep venous reflux. *J Vasc Surg* 1998;28:834-8.
9. Cavezzi A. *Long saphenous vein and perforating veins haemodynamics: "new" echo-colour-doppler patterns Abstr.* Sydney: XIII World Congr of Phlebol, 1998:109.
10. Cavezzi A. *Pre-post-operative colour flow duplex assessment of perforating veins in long saphenous vein stripping and phlebectomies.* *Phlebology* 99. Proceedings of Eur Congr Un Int Phlebol, Bremen Sept. 99;30-1, Viatal Verlag.
11. Cavezzi A, Frullini A. the role of sclerosing foam in ultrasound guided sclerotherapy of the saphenous veins and of recurrent varicose veins: our personal experience. *Australian and New Zealand J of Phlebology* 1999;3(2).
12. Zamboni P, Cappelli M, Marcellino MG, Murgia AP, Pisano L, Fabi P. Does a varicose saphenous vein exist? *Phlebology* 1997;12:74-7.
13. Franceschi C. Physiopathologie hémodynamique de l'insuffisance veineuse des membres inférieurs. En: Kieffer, Bahnini. *Chirurgie des veines des membres inférieurs.* Paris: Ed. AERCV, 1996;19-53.
14. Caggiati A, Ricci S. The long saphenous vein compartment. *Phlebology* 1997;12:107-11.
15. Cappelli M, Molino Lova R, Ermini S, Zamboni P. Fondamenti di emodinamica ed ultrasonografia venosa. In: Zamboni P. *La chirurgia conservativa del sistema venoso superficiale.* Faenza: CELI Ed, 1996;29-50.
16. Abu-Own A, Scurr JH, Coleridge-Smith PD. Saphenous vein reflux without incompetence at the saphenofemoral junction. *British J of Surg* 1994;81:1452-4.
17. Pieri A, Vannuzzi A, Duranti A, Vin F, Caillard Ph, Benelli L, Michelagnoli S, De Saint-Pierre G. Rôle central de la valvule pré-ostiale de la veine saphène interne dans la genèse des varices tronculaires des membres inférieurs. *Phlébologie* 1995;48;(2):227-9, plus ERRATA *Phlébologie* 1995;48(4):V, VI.
18. Somjen GM, Donlan J, Hurse J, Bartholomew J, Johnston AH, Royle P. Venous reflux at the sapheno-femoral junction. *Phlebology* 1995;10:132-5.
19. Tibbs JD, Fletcher EW. Direction of flow in superficial veins as a guide to venous disorders in lower limbs. *Surgery* 1983;6:758-6.
20. Guex JJ, Perrin M, Hiltbrand B, Bayon JM, Henry F, Allaert FA. Répartition topographique des varices. Analyse écho-dopple sur 498 membres inférieurs. *Phlébologie* 1996;49(4):385-8.
21. Negus D. Should the incompetent saphenous vein be stripped to the ankle? *Phlebology* 1986;1:33-6.
22. Koyano K, Sakaguchi S. Selective stripping operation based on doppler ultrasonic findings for primary varicose veins for the lower extremity. *Surgery* 1988;103:615-9.